NASA to athletic Mars rover: 'Stick the landing'

Alicia Chang AP Science Writer

PASADENA, Calif. (AP) -- It's NASA's most ambitious and expensive Mars mission yet - and it begins with the red planet arrival late Sunday of the smartest interplanetary rover ever built. Also the most athletic.

Like an Olympic gymnast, it needs to "stick the landing."

It won't be easy. The complicated touchdown NASA designed for the Curiosity rover is so risky it's been described as "seven minutes of terror" - the time it takes to go from 13,000 mph to a complete stop.

Scientists and engineers will be waiting anxiously 154 million miles away as the spacecraft plunges through Mars' thin atmosphere, and in a new twist, attempts to slowly lower the rover to the bottom of a crater with cables.

By the time Earthlings receive first word of its fate, it will have planted six wheels on the ground - or tumbled itself into a metal graveyard.

If it succeeds, a video camera aboard the rover will have captured the most dramatic minutes for the first filming of a landing on another planet.

"It would be a major technological step forward if it works. It's a big gamble," said American University space policy analyst Howard McCurdy.

The future direction of Mars exploration is hanging on the outcome of this $2.5 billion science project to determine whether the environment was once suitable for microbes to live. Previous missions have found ice and signs that water once flowed. Curiosity will drill into rocks and soil in search of carbon and other elements.

Named for the Roman god of war, Mars is unforgiving with a hostile history of swallowing man-made spacecraft. It's tough to fly there and even tougher to touch down. More than half of humanity's attempts to land on Mars have ended in disaster. Only the U.S. has tasted success, but there's no guarantee this time.

"You've done everything that you can think of to ensure mission success, but Mars can still throw you a curve," said former NASA Mars czar Scott Hubbard who now teaches at Stanford University.

The Mini Cooper-sized spacecraft traveled 8 1/2 months to reach Mars. In a sort of celestial acrobatics, Curiosity will twist, turn and perform other maneuvers throughout the seven-minute thrill ride to the surface.

Why is NASA attempting such a daredevil move? It had little choice. Earlier spacecraft dropped to the Martian surface like a rock, swaddled in airbags, and

bounced to a stop. Such was the case with the much smaller and lighter rovers Spirit and Opportunity in 2004.

At nearly 2,000 pounds, Curiosity is too heavy, so engineers had to come up with a new way to land. Friction from the thin atmosphere isn't enough to slow down the spacecraft without some help.

During its fiery plunge, Curiosity brakes by executing a series of S-curves - similar to how the space shuttle re-entered Earth's atmosphere. At 900 mph, it unfurls its huge parachute. It then sheds the heat shield that took the brunt of the atmospheric friction and switches on its ground-sensing radar.

A mile from the surface, Curiosity jettisons the parachute and fires up its rocket-powered backpack to slow it down until it hovers. Cables unspool from the backpack and slowly lower the rover - at less than 2 mph. The cables keep the rocket engines from getting too close and kicking up dust.

Once the rover senses touchdown, the cords are cut.

Even if the intricate choreography goes according to script, a freak dust storm, sudden gust of wind or other problem can mar the landing.

"The degree of difficulty is above a 10," said Adam Steltzner, an engineer at NASA's Jet Propulsion Laboratory, which manages the mission.

It takes 14 minutes for radio signals on Mars to travel to Earth. The lag means Curiosity will already be alive or dead by the time mission control finds out.

The rover's landing target is Gale Crater near the Martian equator. It's an ancient depression about the size of Connecticut and Rhode Island combined with a 3-mile-high mountain rising from the center of the crater floor.

Scientists know Gale was once waterlogged. Images from space reveal mineral signatures of clays and sulfate salts, which form in the presence of water, in older layers near the bottom of the mountain.

During its two-year exploration, the plutonium-powered Curiosity will climb the lower mountain flanks to probe the deposits. As sophisticated as the rover is, it cannot search for life. Instead, it carries a toolbox including a power drill, rock-zapping laser and mobile chemistry lab to sniff for organic compounds, considered the chemical building blocks of life. It also has cameras to take panoramic photos.

Humans have been mesmerized by the fourth rock from the sun since the 19th century when American astronomer Percival Lowell, peering through a telescope, theorized that intelligent beings carved what looked like irrigation canals. Scientists now think that if life existed on Mars - a big if - it would be in the form of microbes.

Curiosity will explore whether the crater ever had the right environment for microorganisms to take hold.

Even before landing, it got busy taking radiation readings in space during its 352-million-mile cruise - information that should help its handlers back home determine the radiation risk to astronauts who eventually travel to the red planet.

Curiosity's journey has been fraught with bumps. Since NASA had never built such a complicated machine before, work took longer than expected and costs soared. Curiosity was supposed to launch in 2009 and land in 2010, but the mission - already $1 billion over budget - was pushed back two years.

The delay created a cascade. Burdened with budget woes, NASA reneged on a partnership with the European Space Agency to land a drill-toting spacecraft in 2018. The space agency is in the midst of revamping its Mars exploration program that will hinge heavily on whether Curiosity succeeds.

The extra time allowed engineers to test and re-test the rover and all its parts, taking a spacecraft stunt double to the Mojave Desert as if it were Mars. For the past several months, engineers held dress rehearsals at the sprawling JPL campus 10 miles northeast of downtown Los Angeles in anticipation of landing day when they will carry on a decades-old tradition of passing out "good luck" peanuts.

Practice is over. It's show time. To Mars or bust.

Source URL (retrieved on *10/22/2014 - 10:01am*):
http://www.ecnmag.com/news/2012/07/nasa-athletic-mars-rover-stick-landing?qt-recent_content=0